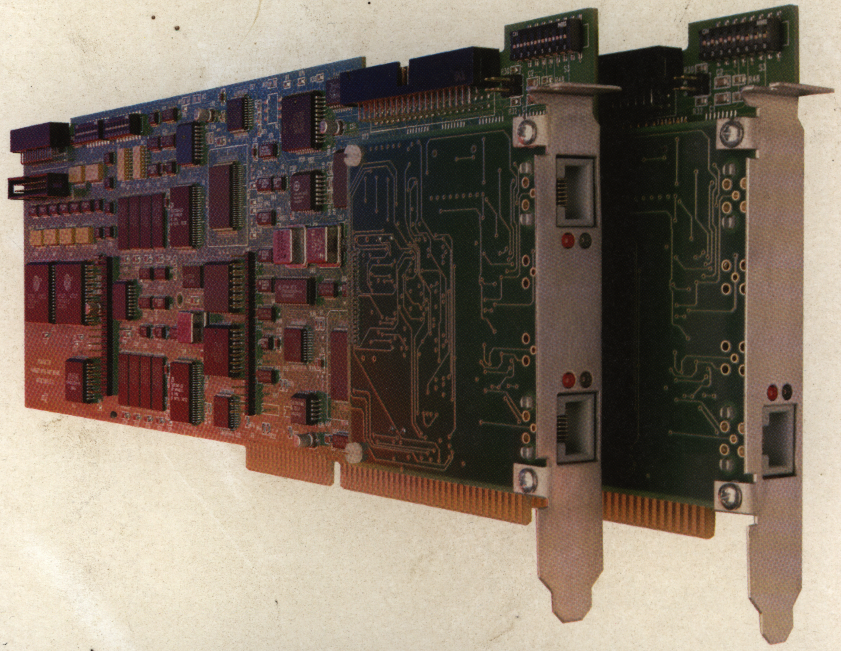

E1-T1 ISDN Access card

Primary Rate Digital Access card (Rev. 5)

Installation Guide

USA - Canada - UK - Europe - Japan - Australia

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MAN 2000

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E1 Digital Access Card
T1 Digital Access Card

Instructions for use

USA - Canada - UK - Europe – Japan - Australia

MAN2000 Version 1.04

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Filename: E1-T1 Instructions for use 1.04.doc

Contents

Section 1 - Introduction 6

1.1 General 6
1.2 Uses of the E1/T1 Card 7
1.3 Telephone Network Attachment 7
1.4 Call Control 8
1.5 Speech and Data Paths 8
1.6 E1/T1 Card Host Interface 9

Section 2 - Card Installation & Connection 10

2.1 Safety Warnings 10
2.2 Card Installation 10
2.3 EMC Compliance 10
2.4 Network Connection 11
2.5 Network Cable Pinout 12
2.6 El Line Interface SMB/BNC Pinout 13
2.7 Network Clock 14
2.8 Timeslot Delays 14
2.9 Bit Integrity 14

Section 3 - Technical Information 15

3.1 The Host PC System 15
3.2 The E1/T1 Card in the PC Environment 15
3.3 Digital Access Card Architecture 16
3.4 The Card I/O Base Address 17
3.5 Setting the Memory Block Base Address 18
3.6 Suitability of Different Host Memory Addresses 18
3.7 E1/T1 Card Interrupt Selection 20
3.8 E1/T1 Card Processor Reset 20
3.9 E1/T1 Port Clock Source 21
3.10 The Digital Switch Matrix 21
3.11 E1 Card Stream Numbering 22
3.12 T1 Card Stream Numbering 23
3.13 Bringing the Card into Service 23
3.14 Establishing an IDLE Pattern 24
3.15 Connecting Calls 24
3.16 MVIP Implementation Details 24
3.17 PEB Implementation Details 26
3.18 SC-Bus Implementation Details 27
3.19 Default Jumper Settings for the E1/T1 Card 28
3.20 Default Switch Settings 29
3.21 Jumper and Switch Positions 30

Section 4 - Appendix 1 - General Approvals Information 31

4.1 Model Number 31
4.2 Approval Details 31
4.3 Usage and Type 31
4.4 Environmental 31
4.5 Network Timing 31
4.6 Power Supply 32
4.7 Approved Functionality 32
4.8 Approval Label 32
4.9 Documentation Release 32
4.10 Software Release 33
4.11 User Responsibilities 33
4.12 Speech Calls 33

Section 5 - Appendix 2 - Country Specific Information 35

Section 6 - Appendix 3 - USA/Canada Approval Details 36

6.1 FCC Connection Requirements 36
6.2 Industry Canada Warnings 37
  6.2.1 Approval Number USA 38
6.3 FCC EMC Requirements 38
6.4 Canadian EMC Requirements 39
6.5 Usage and Type 39
6.6 Functionality 40
  6.6.1 Speech Calls 40
6.7 Card Installation & Connection 40
  6.7.1 Safety Warnings 40
  6.7.2 Line Interface 41
  6.7.3 Network Cable Pinout 41

Section 7 - Appendix 4 - Approval Details for UK 43

7.1 Approval Number 43
7.2 Usage and Type 43
7.3 Approved Functionality 43
  7.3.1 CAS Approved Functionality 44
  7.3.2 DASS-2 (on the PSN) Approved Functionality 44
  7.3.3 Speech Calls 45
7.4 Card Installation & Connection 45
  7.4.1 Safety Warnings 45
  7.4.2 Installation and Safety 46
  7.4.3 Line Interface 46
  7.4.4 Network Connection 47
  7.4.5 Earthing/Grounding of Input and Output Ports 47
  7.4.6 Network Connection via Other Apparatus 47
7.5 The MEF Watchdog 48

Section 8 - Appendix 5 - Approval Details For European Union Countries............. 49

8.1 CE Approval... 49
8.2 Usage and Type... 50
8.3 Approved Functionality.. 50
    8.3.1 Speech Calls... 50
8.4 Card Installation & Connection 51
    8.4.1 Safety Warnings.. 51
    8.4.2 Line Interface.. 51
    8.4.3 Network Cable Pinout 51
    8.4.4 Installation and Safety.. 52

Section 9 - Appendix 6 - Approval Details for Japan.. 54

9.1 Approval Number... 54
9.2 Usage and Type... 54
9.3 Functionality... 54
9.4 Speech Calls... 55
9.5 Card Installation & Connection 55
9.6 Safety Warnings.. 55
9.7 Line Interface.. 55
9.8 Network Cable Pinout 56

Section 10 - Appendix 7 – Approval details for Australia..................................... 57

10.1 Approval Number... 57
10.2 Usage and Type... 57
10.3 Approved Functionality... 57
10.4 Speech Calls.. 58
10.5 Card Installation & Connection 58
10.6 Safety Warnings.. 58
10.7 Network Cable Pinout 59

Section 11 - Technical Specification... 60

Section 1 - Introduction

1.1 General

This document is the instructions for use for

- the Aculab E1/T1 Digital Access Card, model M1 (with a single E1 or T1 port) and model M2 (with two E1 or T1 ports fitted)
- the Aculab E1/T1 Digital Access Card, model M2 (with a single T1 port and a single E1 port)

All these products are referred to in this document as the 'E1/T1 card' unless the context requires a more specific term.

This introductory section of this document provides a general description of the E1/T1 card, and it's features and facilities.

The second section, **Card Installation & Connection**, in conjunction with the country-specific appendices, detail the conditions of the Approval for connection to the telephone network, requirements for installation and safety, and other regulatory matters. This section and the appropriate country-specific appendix contain many statements regarding your use of the E1/T1 card that are **legal** requirements for connection to the public network. Failure to use the E1/T1 card in accordance with any of these instructions for use may invalidate the approval for connection.

The third section, **Technical Information**, refers to installation of the E1/T1 card into a host computer, and subsequent connection to the network, and provides hardware control and configuration information.

Appendix 1 provides general Approvals information related to the other sections of this document. To fully appreciate the conditions of Approval for connection to the telephone network, it is important that the appropriate country-specific appendices are read in connection with the other sections of this document.

Call control and digital switch control functions are provided via one of several device drivers that are described in separate publications specific to those topics. Note that the card is not in itself a complete product, and only has usable functionality when associated with a host computer, an application program, and, usually, various other attached speech and data components.

Note: **These instructions for use assume that these various elements are being assembled and integrated by someone competent in such matters and does not constitute an alternative for such competence.**

1.2 Uses of the E1/T1 Card

The E1/T1 card is a plug-in card suitable for use in many different types of IBM PC/AT or ISA compatible computer, and provides a means of connection between the digital telephone network and various kinds of PC based speech and data products from different vendors.

Examples of cards that may be used with the E1/T1 card are single or multiple channel:

Speech recognition cards
Speech processing cards
FAX cards
Data communications cards
Video conferencing cards

The use of the E1/T1 card along with such products allow the integration of a number of different types of automatic and semi-automatic telephone and telecommunication based services.

The E1/T1 card provides an MVIP bus (Multi-Vendor Integration Protocol) and two PEBs (PCM Expansion Buses) or a single SC-Bus that allow its use with a very wide range of third-party products. It contains a 380x380 digital switch matrix that allows arbitrarily switched interconnection between the 60 channels on the E1-network or 46 channels on the T1-network, 256 speechpaths (timeslots or channels) on the MVIP bus, and 64 speechpaths on the two PEB or single SC-Bus ports.

Control of the E1/T1 card is via a low-level interface ported to the PC bus itself. The card is essentially operating system independent, and may be used in a DOS, OS/2, UNIX, WindowsNT, or indeed any other operating system environment, through the use of a suitable device driver. Please contact Aculab plc for information on device driver availability.

1.3 Telephone Network Attachment

The E1 card attaches to the 2Mbit system or Primary Rate (2.048 Mbit/s) Integrated Services Digital Network (ISDN), via a service provision often used to connect digital PBXs to the telephone network (NT1). The T1 card attaches to the 1.544Mbit system via a Channel Service Unit (CSU).

The E1 card is available with either one or two sets of connections and so may make or receive up to 30, or up to 60 separate calls at one time. The T1 card is available with either one or two sets of connections and so may take or receive up to 23 or 46 separate calls at one time.

Please refer to the appendices following **Country Specific Information** for more details of the various international connections.

1.4 Call Control

Processors on the E1/T1 card (one processor per E1/T1 port) control all of the call signalling (set-up, acceptance and clearing etc.) in response to commands from an application program running on the host computer.

The call control interface itself to the card itself is at a low level (in signalling terms), and this provides maximum information and control over the various stages of call progress. This interface is normally accessed via a device driver that has been prepared for the operating system in use. See the **Device Driver Installation** manual for the appropriate call control information.

Each outgoing message, provided by the application program via the device driver, is checked by the card processor for syntax, validity of content and context. If errors are found, the call is automatically cleared. The software on the card, therefore, forms an effective barrier between the application program and the telephone network, and protects the network from incorrect call signalling.

Several elements of call signalling related information are available to the application program, although in some cases this depends upon provision by the PTO of certain information along with each call. One such information element is the number used by the caller on calling into the card, (the DDI number); this is only available when the service obtained from the PTO is of the appropriate type. Another such information element, which may be available according to the protocol and PTO, is Calling Line Identity (CLI), which, on incoming calls, makes the telephone number of the calling party available to the application program.

1.5 Speech and Data Paths

Speech and data associated with telephone calls are not terminated on the card itself, but are always switched without modification to other cards for processing. The card maintains bit integrity within timeslots between ports on the card.

There are four broad categories of Multi-channel path provided by the card, as follows:-

1. E1 (G703) ports - 30 or 60 calls (2Mbit system or ISDN) or
   T1 (G703) ports - 23/24 or 46/48 calls (1.554Mbit T1 system or T1 PRI)
2. The MVIP bus - 256 bi-directional speechpaths.
3. The two PEBs - 32 bi-directional speechpaths each.
4. The SC-Bus - 64 bi-directional speechpaths (out of a possible 512)

For T1 PRI applications, timeslot 24 on each trunk is typically used for signalling, so only 23 timeslots are available for calls.

Note that the card may be configured for either PEB *or* SC/Bus operation, not both.

Together, these provide paths to 380 different end-points. Any of these individual endpoints may be connected to any other endpoint via the 380x380 digital switch provided on the card.

Additionally, any one 'source' of speech or data may be distributed to a number of separate 'sinks', but note that it is not possible via switching on the card for more than one source to feed a single sink. This conferencing function is only possible with the use of extra processing power of the Aculab AT&T DSP module, Aculab Prosody modules or third party cards.

1.6 E1/T1 Card Host Interface

A device driver program running on the host computer controls the behaviour of the E1/T1 card. The driver accesses the card via a control space within an area of shared RAM, which is a block of memory physically resident on the card itself, but which appears in the memory map of the host computer as a normal area of memory.

The address of the shared RAM in the host computer is determined by the device driver writing to an I/O port in the host memory map. The I/O port itself may be set via user configurable DIP switches on the card.

Several E1/T1 cards may be installed in a single host computer and set to different I/O addresses, and will be switched through the same memory area by the device driver.

Within the area of memory occupied by the E1/T1 card is:

- A 16k memory block controlling one port processor.
- A 16k memory block controlling the other port processor.
- A memory block controlling clocks and the switching resources.

Thus, when enabled into the PC memory map, the card or cards occupy a memory area, which must be free of other memory-mapped devices at the time the cards are accessed.

The size of the area used in the PC memory map is configurable to be either 64K bytes or 16K bytes. The 64K size is that used by older versions of the card and is the default size that is used by driver software.

Section 2 - Card Installation & Connection

2.1 Safety Warnings

Seek advice from a competent telecommunication engineer before installation and connection to the network is made.

The network ports on the card are only suitable for connection to TNV circuits operating as SELV (TNV class 1).

There are four interconnection ports on the card other than the network ports. These ports have the following safety status:

Type of Circuit	Label on PCB	Port Description
SELV	J1/J2	PC/AT Bus Interface (ISA)
SELV	J3	MVIP Telecommunications Bus
SELV	J6	SC-Bus Telecommunications Bus
SELV	J7	PEB Telecommunications Bus

See the appendices following the **General Approvals Information** for additional safety related information.

2.2 Card Installation

The installation procedure for expansion cards will vary from one type of host computer to another, and the exact details of the installation procedures for expansion cards must be sought in the user guide supplied by the host computer manufacturer. However, in general:

- Do not attempt to install or remove the E1/T1 card unless the mains power supply is completely removed from the host computer and the network port is disconnected from the network.

- To ensure safety, any covers removed from the host computer in order to install the E1/T1 card must be replaced before the mains power supply is reconnected.

- Do not connect the E1/T1 card to the 2.048/1.554 Mbit/s service or Primary Rate ISDN network termination port until this document, and in particular the sections marked 'Network Connection', have been read in full and understood.

2.3 EMC Compliance

The card has been tested for compliance with EMC regulations in the USA, Canada, the UK, Europe, Japan and Australia in conjunction with a PC that was itself compliant. This does not in itself guarantee that every EMC compliant PC will remain compliant when used with the card. In extreme cases, high frequency energy within the PC may be conducted out of the PC and re-radiated via the network cables, and in this case the network cables may require additional treatment (such as clamp-on ferrite rings), and system-grounding provisions may require revision.

Good quality shielded cables must be used for the network connections in all cases.

If there is doubt regarding the EMC performance of a particular system, the user is advised to obtain competent advice, and, possibly, local systems testing for EMC.

2.4 Network Connection

The conditions of initial connection between the E1/T1 card and the network must be agreed with the local office of the public telecommunications operator (PTO) and should only be carried out by competent installation personnel, or if required, a representative of the PTO.

There may also be special requirements regarding when and how the system may be subsequently taken into and out of service, and the host computer powered up and powered down. This too should be agreed with the local office of the PTO.

Consult the local office of the PTO for advice on the connection to the network termination port (NTP) supplied by the PTO. For example, there may be maximum cable lengths imposed by the PTO.

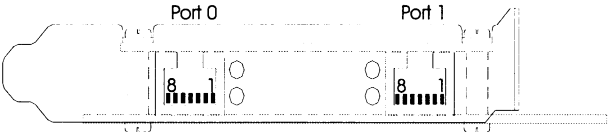
The model M2 of the E1/T1 card has two E1/T1 ports, the lower connector(s) on the end-panel of the card is port 0, and the upper connector(s) is port 1. Model M1 has only a single port, port 0. Please refer to the appendices following **Appendix 2 - Country Specific Information** for additional details according to the interface type.

2.5 Network Cable Pinout

For the E1 card, the connection from the network interface to the network may be either (i) using an RJ45 connector, or (ii) using SMB coaxial connectors with SMB/BNC adapters. For the T1 card, the connection from card to the network uses an RJ48 (FCC part 68 subpart D) compliant connector.

The following is a reference summary of the pinout variants.

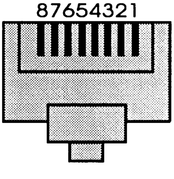
E1/T1 Line Interface RJ45/RJ48 Pinout



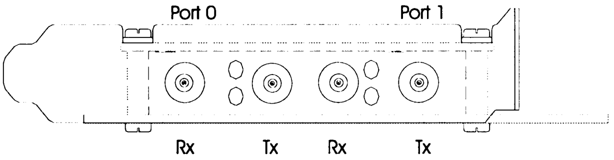
RJ45/RJ48 pinout:		
PIN	DESCRIPTION	DIRECTION
1	line receive (tip)	input
2	line receive (ring)	input
3	receive cable shield	
4	line transmit (tip)	output
5	line transmit (ring)	output
6	transmit cable shield	

RJ45 Connector

(front View)



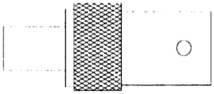
2.6 E1 Line Interface SMB/BNC Pinout



SMB/BNC pinout: PIN	 DESCRIPTION
inner	tip (signal)
outer	ring (shield)

For U.K users of the SMB/BNC line interface should be used with the SMB/BNC adaptor (Radiall R191215000, Aculab D02022) and for the rest of the world it is optional.

SMB/BNC adaptor



2.7 Network Clock

In order to ensure correct operation of the network connection, particular care must be taken over the selection of the transmit clock source for the E1/T1 card.

The simplest way to ensure that appropriate transmit clocks are used is to ensure that the clock source is derived from a receive port also connected to the network. If the clock is sourced on the card itself it is often chosen that port 0 (the lower connector on the end-panel) provides the clock.

If port 1 is connected to the public network, then it may alternatively be used as the network clock reference instead of port 0.

In the above cases, the clock sources for both the MVIP bus and the SC-Bus/PEB are normally derived from the reference port on the card.

In the event that there is more than one E1/T1 card in a system, clearly only one port on one card may be the source of the reference clock. In this case, the transmit ports on the E1/T1 card not sourcing the clock may be configured to take timing from the MVIP bus or the SC-Bus (provided the clock source has appropriate jitter and wander performance, which is only guaranteed when using a second E1/T1 card).

The actual clock source for the E1/T1 card is selected via the device driver - see the manual for the switch device driver for details.

2.8 Timeslot Delays

The range of possible transit delays for normal B-channel routes through the E1/T1 card is as shown below. A normal delay is that encountered from one of the G703 ports to the MVIP bus, the SC-Bus/PEB bus, or the other G703 port, although it is possible to contrive complex switching configurations that re-circulate through the switch matrix and introduce greater delays. Once a signal path has been established through the card, the timeslot delay is fixed.

	Frames	μS
Minimum delay	0	0
Typical delay	1-2	125 - 250
Maximum delay (see note above)	4	500

2.9 Bit Integrity

The card retains bit integrity between its network ports and it's MVIP and SC-Bus/PEB ports. That is, there is no distortion in gain or frequency terms via any path through the card.

Section 3 - Technical Information

Note: **Many of the issues discussed in this chapter are handled internally by the device driver, and consideration by the user need only be given to the selection for I/O Base Address, Memory Base Address, and Interrupt.**

However, many other hardware details are included here for information purposes, and to aid in understanding the operation of the card.

3.1 The Host PC System

An E1/T1 card may in principle be fitted to any computer with a PC/AT compatible (ISA) bus, however it is the responsibility of the user and/or application developer to determine the suitability of any particular system configuration with respect to a particular application.

Due to the inclusion of on-board processors, the E1/T1 card has been designed so that it will function consistently even when fitted to a PC that cannot itself cope with the processing workload of the application.

3.2 The E1/T1 Card in the PC Environment

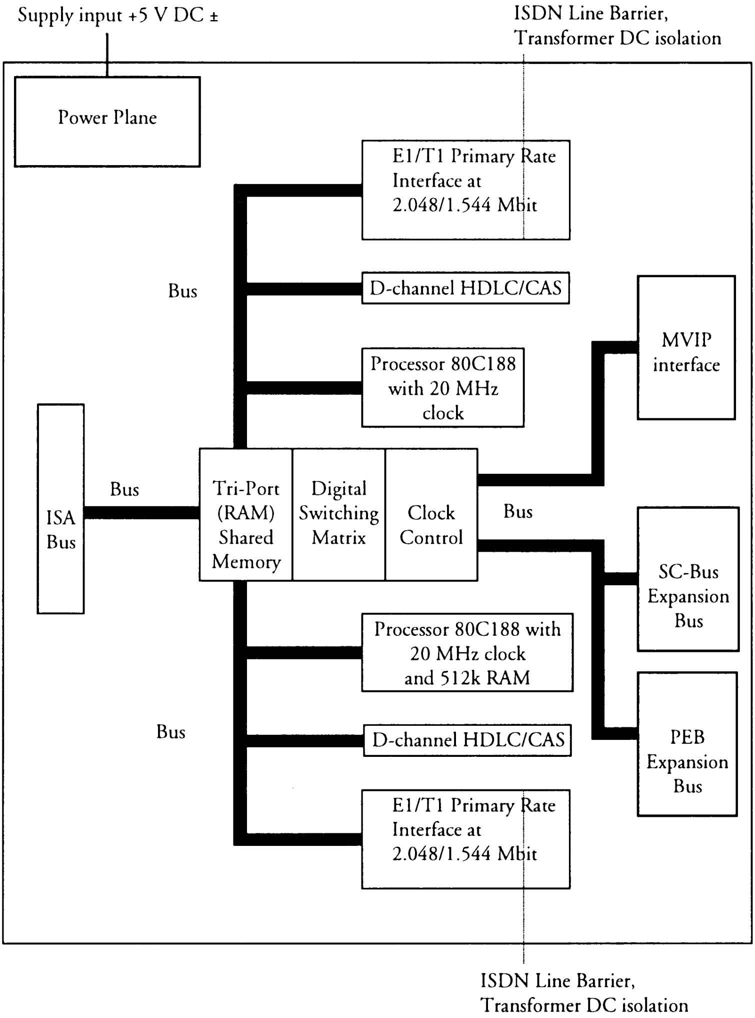
Most of the high-level control of the E1/T1 card is accomplished via an area of shared memory on the E1/T1 card that is mapped into the PC's memory space. This area contains the control spaces for the two port processors, the control space for the on-board digital switch, and the system master clock control port.

The address (MEMBASE) of the memory block containing these elements is determined by the device driver writing to a pair of I/O port addresses (at IOBASE), and this in turn is selected by a dip-switch mounted on the board itself. Multiple cards may use a single memory block, but separate I/O address blocks are required.

The E1/T1 card also uses a single interrupt line, which may also be shared amongst multiple cards.

Default I/O address, memory address and interrupt, is assumed by the device drivers, and the default selection is usually the most appropriate choice. However, for special purposes, different selections may be used via device driver command line options (or by alternative means - see the device driver documentation for details).

3.3 Digital Access Card Architecture


Supply input +5 V DC ±
ISDN Line Barrier, Transformer DC isolation
Power Plane
E1/T1 Primary Rate Interface at 2.048/1.544 Mbit
Bus
D-channel HDLC/CAS
MVIP interface
Processor 80C188 with 20 MHz clock
ISA Bus
Bus
Tri-Port (RAM) Shared Memory
Digital Switching Matrix
Clock Control
Bus
SC-Bus Expansion Bus
Processor 80C188 with 20 MHz clock and 512k RAM
Bus
D-channel HDLC/CAS
PEB Expansion Bus
E1/T1 Primary Rate Interface at 2.048/1.544 Mbit
ISDN Line Barrier, Transformer DC isolation

The hardware architecture of the Aculab E1/T1 card.

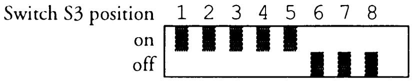
3.4 The Card I/O Base Address

The E1/T1 card has one user configurable switch to set the address at which the card set-up registers appear in the host computer I/O space (IOBASE). The I/O address should be chosen so as not to clash with any other peripheral devices installed in the system. The normal usage of I/O addresses in AT compatible computers is as follows:

Hex Range	Device
000-0FF	Internal system board
1F0-1F8	Fixed Disc
200-207	Reserved
21F	Reserved
278-27F	Parallel Printer Port 2
2B0-2DF	Alternate Enhanced Graphics Adapter
2E1	GPIB Adapter 0
2E2-2E3	Data Acquisition Adapter
2F8-2FF	Serial Port 2
300-31F	Prototype Card
360-36F	PC Network (low address)
364-367	Reserved
378-37F	Parallel Printer Port 1
380-38F	SDLC, bisync 2
390-393	Cluster controller
3A0-3AF	Bisync 1
3B0-3BF	Monochrome Display and Printer Adapter
3C0-3CF	Enhanced Graphics Adapter
3D0-3DF	Colour/Graphics Monitor Adapter
3F0-3F7	Diskette Controller
3F8-3FF	Serial Port 1

The above usage list is not fixed, nor is it exhaustive, so other devices may have been installed which will necessitate a check for an unused I/O address.

The E1/T1 card I/O base address (IOBASE) is selected by setting the eight position DIP switch (S3) to match the most significant eight bits of the binary address. A switch in the OFF (or OPEN) position corresponds to a binary ONE at that position of the address. The individual switches are numbered from 1 to 8, with switch position 8 controlling the most significant bit of the address. An example of the switch settings is shown in the following diagram:



Switch ways (note reversed order)	8	7	6	5	4	3	2	1	-	-
Binary address	1	1	1	0	0	0	0	0	0	0
Hex address	3		8				0			

Since the two least significant addresses are decoded independently of the switch, the above example shows an I/O base address of IOBASE = 1110000000 (binary), or 0x380 (hexadecimal). This is the default address that will be set upon manufacture.

Note that the E1/T1 card always occupies four addresses in the host computer I/O space, starting at the base address set on the switch.

If more than one card is to be fitted in the same computer, then each must be configured to a different base address.

3.5 Setting the Memory Block Base Address

The memory base address is established by the call and switch control device drivers writing specific values to I/O registers at IOBASE, but a suitable memory address must be determined for the device drivers to use.

Note that several cards may be alternately accessed at the same memory block address, as the device drivers disable cards not currently being accessed.

3.6 Suitability of Different Host Memory Addresses

Depending upon application and upon operating environments, certain memory address allocations for the control space may be more or less suitable than others. Some of the alternatives are discussed below. Note that a complete contiguous 16k block is required:

8000:0000 and 9000:0000. These addresses below 1MB are usable when the host PC can be configured so that only 512K of RAM appears in the low memory map. This reduces the main PC RAM to 512K, which may not be at all important in an OS/2 or UNIX environment, but may be very restrictive for use under DOS.

A000:0000. This address may be suitable when using a monochrome display adaptor (MDA) which usually uses only B000:0000 to B000:1000, or when using EGA or VGA adapters in text only, or simple graphics modes.

C000:0000. This address may be suitable when using a monochrome display adaptor, but is typically not available when using VGA, as VGA cards often have a video BIOS ROM at C000:8000, which will contend with accesses to the E1/T1 card.

D000:0000 and E000:0000. These addresses above 640k but below 1MB are usually the most suitable selections, but beware of other cards also using these areas. In particular, some LAN cards and some intelligent and semi-intelligent disk controller cards also use these memory addresses. It is also becoming common for the region towards the end of the E000 segment to be used by the BIOS, particularly in systems containing a PCI bus.

In particular, some 16-bit VGA cards (and perhaps other cards using 16-bit accesses) can cause problems between D000:0000 and D000:FFFF even though they are themselves accessed only within the C000:0000 to C000:FFFF area. If problems are experienced during initialisation of the E1/T1 card in this memory range, try setting the VGA (or other) card for 8-bit accesses, or alternatively try a different type of VGA card.

Note that BIOS RAM 'shadowing' must be disabled for the chosen memory range, and memory managers such as QEMM, 386MAX and EMM386 must be prevented from utilising the chosen memory area for either expanded memory pages, or for high- loading programs or device drivers.

Some speech processing cards also tend to use these memory addresses, but as the E1/T1 card is very frequently used along with such cards, direct support for sharing memory spaces with many such cards is provided by the E1/T1 card device drivers. See the device driver documentation for further information.

10000:0000. Addresses above 1MB may be useful when using operating systems that support 386, 486 and Pentium processors in 32-bit mode, and when using DOS with a 386 mode DOS extender. Great care must be taken as the processor often caches the memory space above 1Mb in a PC, and such caching must be disabled if such a procedure is to be successful.

Note that the whole E1/T1 card memory block is mapped as a 'normally not ready' area for PC bus handshaking, so if an inappropriate access occurs to this area, the entire PC may hang. The supplied device drivers will not make such inappropriate accesses, so this effect should only be experienced when investigating the region using DEBUG or a similar program. Device drivers for the card maintain the card switched out of the PC's memory map when not being accessed, so in this case the effect will not normally be observed even when inadvertently accessing this area.

3.7 E1/T1 Card Interrupt Selection

The E1/T1 card uses one interrupt, and the interrupt that is used is software configurable via device driver options. The available interrupt lines are as follows:

IRQ3
IRQ5
IRQ7
IRQ10
IRQ11
IRQ12
IRQ14
IRQ15

The interrupt termination option provides a 100R pull-down termination to the interrupt line. If only one E1/T1 card is present in the PC, the option should always be used. If more than one E1/T1 card is to share a single interrupt line (an issue that is determined by the device drivers) a termination option should only be used on one of the cards sharing the interrupt.

The E1/T1 card interrupt line should be chosen so as not to clash with other peripheral devices installed in the system. The normal usage of the above interrupts in ISA compatible computers is as follows. This list is not fixed, nor is it exhaustive, and other devices may have been installed which will necessitate a check for an unused interrupt line.

Interrupt	Normal Usage
IRQ3	Serial Port COM2
IRQ5	Parallel Printer Port LPT2
IRQ7	Sound Card
IRQ10	Unused
IRQ11	Unused
IRQ12	Unused
IRQ14	IDE hard disc controller
IRQ15	Unused

3.8 E1/T1 Card Processor Reset

The processors on the E1/T1 Card enter a hardware reset state during power up and power down of the host PC, and any time the +5V power supply from the host PC drops below a voltage at which proper operation can be established. The supply voltage threshold is configured as 4.5V (-10% of nominal).

Another reason for a processor to reset would be on failure of the processor circuitry, or on-board signalling software, or prior to reloading of RAM based signalling software to the card. When these events occur, the E1/T1 card communication with the network stops until the signalling software is explicitly restarted.

As the two port processors are entirely independent, a reset on one processor will not affect the behaviour of the other processor on the card.

3.9 E1/T1 Port Clock Source

The possible card reference clock sources are:

Card network port 0 receive.
Card network port 1 receive.
MVIP bus main clock (sourced from another card).
MVIP bus SEC8K (the MVIP secondary 8kHz reference).
Card local clock reference.
SC-Bus clock (sourced from another card).

Clocking for each transmit port is always derived from the reference source selected for the card. If a card has it's clock reference source set to be one of it's network receive ports, the local oscillator, or SEC8K, (i.e. is not explicitly set to take it's clock from the MVIP or SC-Bus bus), then the card may also be the MVIP or SC-Bus clock master and drive clocking to the MVIP and SC-Bus ports. (Note that if a receive port is not receiving any signal, and it is set to be the card reference source, the clock will automatically fall back to the card's local clock source).

There are elastic buffers on each receive port of the card that will absorb certain smaller variations in frequency (known as 'jitter' and 'wander') between the received signal and the card's selected reference clock. To avoid the occurrence of errors known as 'frame slips' between the card MVIP/SC-bus and the receive ports, all clocks in a system must be derived from a suitable master reference source.

There is a basic assumption that all public network service provisions are synchronised to a single common clock source somewhere in the network, and this results in all network services having the desired degree of clock coherency. Thus, provided that all ports and the MVIP or SC-Bus use a clock that has been derived from a network service, short-term variations will be absorbed and correct long-term synchronisation will be maintained.

Selection of the master clock source for the card is accomplished via the switch device driver, see the documentation for the switch device driver for further information.

3.10 The Digital Switch Matrix

Four digital switch devices form a matrix for switching the channels between the network ports, HDLC/CAS controllers, the MVIP bus, and the SC-Bus/PEB busses. This is arranged as an array of 2 Mbit/s streams, each with 32 channels (or timeslots). Control of the use of these streams and timeslots is via the switch control device driver. Each input and output stream is allocated a number to simplify the programming model. The stream numbering is shown in separate following tables for the E1/T1 card:

3.11 E1 Card Stream Numbering

Stream Name	Available Channels	Stream Number	Details
MVIP stream 0	0-31	0	(normal direction)
MVIP stream 1	0-31	1	(normal direction)
MVIP stream 2	0-31	2	(normal direction)
MVIP stream 3	0-31	3	(normal direction)
MVIP stream 4	0-31	4	(normal direction)
MVIP stream 5	0-31	5	(normal direction)
MVIP stream 6	0-31	6	(normal direction)
MVIP stream 7	0-31	7	(normal direction)
MVIP stream 0	0-31	8	(reverse direction)
MVIP stream 1	0-31	9	(reverse direction)
MVIP stream 2	0-31	10	(reverse direction)
MVIP stream 3	0-31	11	(reverse direction)
MVIP stream 4	0-31	12	(reverse direction)
MVIP stream 5	0-31	13	(reverse direction)
MVIP stream 6	0-31	14	(reverse direction)
MVIP stream 7	0-31	15	(reverse direction)
Network Port 0	1-15,17-31	16	Port 0 bearer channels
Network Port 0	16	16	Port 0 signalling channel
HDLC 1 & DSP 1	0-15,17-31	17	HDLC, DSP 1 access
HDLC 1 & DSP 1	16	17	Port 0 HDLC/CAS chip
Network Port 1	1-15,17-31	18	Port 1 bearer channels
Network Port 1	16	18	Port 1 signalling channel
HDLC 2 & DSP 2	0-15,17-31	19	HDLC, DSP 2 access
HDLC 2 & DSP 2	16	19	Port 1 HDLC/CAS chip
PEB 1	0-31	20	resource data
DSP 3 access	0-31	21	DSP 3 (if fitted)
PEB 2	0-31	22	resource data
DSP 4 access	0-31	23	DSP 4 (if fitted)
SC-Bus access	0-1023	24	

3.12 T1 Card Stream Numbering

Stream Name	Available Channels	Stream Number	Details
MVIP stream 0	0-31	0	(normal direction)
MVIP stream 1	0-31	1	(normal direction)
MVIP stream 2	0-31	2	(normal direction)
MVIP stream 3	0-31	3	(normal direction)
MVIP stream 4	0-31	4	(normal direction)
MVIP stream 5	0-31	5	(normal direction)
MVIP stream 6	0-31	6	(normal direction)
MVIP stream 7	0-31	7	(normal direction)
MVIP stream 0	0-31	8	(reverse direction)
MVIP stream 1	0-31	9	(reverse direction)
MVIP stream 2	0-31	10	(reverse direction)
MVIP stream 3	0-31	11	(reverse direction)
MVIP stream 4	0-31	12	(reverse direction)
MVIP stream 5	0-31	13	(reverse direction)
MVIP stream 6	0-31	14	(reverse direction)
MVIP stream 7	0-31	15	(reverse direction)
Network Port 0	0-22	16	Port 0 bearer channels
Network Port 0	23	16	Port 0 signalling channel or 24th bearer channel
HDLC 1 & DSP 1	0-15,17-31	17	HDLC, DSP 1 access
HDLC 1 & DSP 1	16	17	Port 0 HDLC/CAS chip
Network Port 1	0-22	18	Port 1 bearer channels
Network Port 1	23	18	Port 1 signalling channel or 24th bearer channel
HDLC 2 & DSP 2	0-15,17-31	19	HDLC, DSP 2 access
HDLC 2 & DSP 2	16	19	Port 1 HDLC/CAS chip
PEB 1	0-31	20	resource data
DSP 3 access	0-31	21	DSP 3 (if fitted)
PEB 2	0-31	22	resource data
DSP 4 access	0-31	23	DSP 4 (if fitted)
SC-Bus access	0-1023	24	

The main difference between E1 and T1 is the number and position of channels available on the network ports.

The DSP referred to, is the optional AT&T DSP module containing up to four DSP devices. These are typically used for CAS signalling systems that require tone generation and detection.

3.13 Bringing the Card into Service

At power-on, the card presents a 'no-signal' condition to the E1/T1 G703 ports. As a minimum, at start-up, the following conditions must be established via the device drivers:

a) A clock source for the card, MVIP bus and/or SC-Bus/PEB must be selected.

b) The network output channels should be set to transmit the ISDN IDLE character (0x2A).

c) The HDLC/CAS signalling controllers must be connected to timeslot 16 (if E1)/timeslot 23 (if T1) of their respective ports. This is not necessary for robbed bit protocols.

Calls to the switch control device driver must be made in order to establish the above conditions.

E1/T1 cards require software to be loaded onto the card before the START command may be given. Call control device drivers that support RAM loading are used to load the signalling software to the card.

Once started, the processors attempt to establish layer 2 connections with the network exchange, which will continue until disconnected, reset or powered-off.

3.14 Establishing an IDLE Pattern

A usual requirement of the approval for connection to the public network is that the correct IDLE character (0x2A, representing 0Vdc 'silence') is transmitted to the exchange on each B-channel that has no call in progress. This may be established via the switch control device driver, setting PATTERN mode with the value 0x54 (characters are transmitted on the network in a bit reversed fashion). This is particularly important for T1 robbed bit connections as a minimum "ones density" **must be** maintained.

3.15 Connecting Calls

When a call is established, the application must ensure that both the incoming and outgoing speech paths are connected to the appropriate MVIP or SC-Bus/PEB speech resource. This is established via the switch control device driver.

Subsequent to the call being cleared, the IDLE pattern must be re-established on the port.

3.16 MVIP Implementation Details

There is a single MVIP bus interface on the board. A summary of MVIP implementation is given below:

- The E1/T1 card is MVIP Enhanced Switching compliant.

- The E1/T1 card provides a Network Interface function, and may be configured to drive or receive the three MVIP clock signals under software control.

- Either of the two network ports or the SEC8K signal may be used as a reference for generating MVIP bus clocks.

- Two clock termination jumpers are provided (JP3, JP4)

The switch matrix allows any network channel to be connected to any other network channel in addition to full connectivity between any MVIP bus timeslots.

The MVIP switch consists of four digital channel switch devices arranged in a 16 input stream, 16 output stream matrix. However the first eight streams (in and out) are switched between the eight DSi and DSo streams on the MVIP, on channel boundaries under the control of registers in the switch devices. This gives connectivity between 24 input streams and 24 output streams.

The software model of the MVIP switch is shown separately for the E1 card and T1 card below:

Software model of the MVIP switch for the E1 card	
streams 0 - 7	MVIP streams, normal direction
streams 8 - 15	MVIP streams, reversed direction
stream 16	Port 0 B-chs (timeslots 1-15,17-31) and D-chs (timeslot 16)
stream 17	Port 0 HDLC/CAS controller (timeslot 16)) and DSP1 (timeslots 0-15, 17-31)
stream 18	Port 1 B-chs (timeslots 1-15,17-31) and D-ch (timeslot 16)
stream 19	Port 1 HDLC/CAS controller (timeslot 16)) DSP2 (timeslots 0-15, 17-31)

Note 1: **For the E1 card, timeslot 16 on the network port carries the HDLC or CAS signalling channel, or D-channel.**

Note 2: **The capability for completely arbitrary switching on the E1 card means that integration of facilities provided by resource cards on the PEB buses or resource cards on the MVIP bus is possible.**

Software model of the MVIP switch for the T1 card	
streams 0 - 7	MVIP streams, normal direction
streams 8 - 15	MVIP streams, reversed direction
stream 16	Port 0 B-chs (timeslots 0-22) and either D-ch or 24th B-ch (timeslot 23)
stream 17	Port 0 HDLC/CAS controller (timeslot 16)) and DSP1 (timeslots 0-15, 17-31)
stream 18	Port 1 B-chs (timeslots 0-22) and either D-ch or 24th B-ch (timeslot 23)
stream 19	Port 1 HDLC/CAS controller (timeslot 16) DSP2 (timeslots 0-15, 17-31)

Note 1: **For T1 PRI, timeslot 23 (often referred to as channel 24) on the network port carries the HDLC signalling channel, or D-channel.**

Note 2: **The capability for completely arbitrary switching on the T1 card means that integration of facilities provided by resource cards on the PEB buses or resource cards on the MVIP bus is possible.**

3.17 PEB Implementation Details

There are two identical PEB interfaces on the board. A summary of PEB implementation is given below:

- The E1/T1 card is a Network Module, and always provides the Master Clock Source.
- The PEB clocking is Synchronous E1 Timing (2.048 MHz) with 32 timeslots.
- Passive Signalling is provided controlled by the E1/T1 card.

The PEB interfaces are intended for use only in terminate configurations. The crossover configuration is not supported on the card due to a limitation in the SC2000 device. However, 'drop and insert' functionality between two network ports on separate cards can be achieved via the switch matrix.

Since there can only be one Network Module in a system without a crossover, the board is always a clock master on the PEB bus. The clock master/slave exchange protocol is not implemented.

Robbed-bit signalling or asynchronous timing is not supported.

All signalling through each network port is strictly under the control of the relevant processor, so this implementation is restricted to the use of Passive Signalling controlled by the E1/T1 card signalling software.

3.18 SC-Bus Implementation Details

There is one SC-Bus interface on the board. When SC-Bus operation is selected then connector J6 is used for all SC-Bus connections and connector J7 is unused.

- A summary of SC-Bus implementation is given below:
- The E1/T1 card can source or sink the SC-Bus clocks.
- The SC-Bus clocking is 4.096 Mbit/s with up to 512 channels.
- Each E1/T1 card supports up to 64 bi-directional connections to the SC-Bus
- Message channel is supported (but currently not implemented).

Software model for the E1 card	
stream 16	Network port 0 B-chs (timeslots 1-15, 17-31) and D-ch (timeslot 16)
stream 17	Network port 0 HDLC/CAS controller (timeslot 16) and DSP1 (timeslots 0-15, 17-31)
stream 18	Network port 1 B-chs (timeslots 1-15, 17-31) and D-ch (timeslot 16)
stream 19	Network port 1 HDLC/CAS controller (timeslot 16) and DSP2 (timeslots 0-15, 17-31)
stream 20	PEB bus 1 resource data
stream 21	DSP 3 access (timeslots 0-15, 17-31)
stream 22	PEB bus 2 resource data
stream 23	DSP 4 access (timeslots 0-15, 17-31)
stream 24	SC-Bus (timeslots 0-1023)

Software model for the T1 card	
stream 16	Network port 0 B-chs (timeslots 0-22) and either D-ch or 24th B-ch (timeslot 23)
stream 17	Network port 0 HDLC/CAS controller (timeslot 16) and DSP1 (timeslots 0-15, 17-31)
stream 18	Network port 1 B-chs (timeslots 0-22) and either D-ch or 24th B-ch (timeslot 23)
stream 19	Network port 1 HDLC/CAS controller (timeslot 16) and DSP2 (timeslots 0-15, 17-31)
stream 20	PEB bus 1 resource data
stream 21	DSP 3 access (timeslots 0-15, 17-31)
stream 22	PEB bus 2 resource data
stream 23	DSP 4 access (timeslots 0-15, 17-31)
stream 24	SC-Bus (timeslots 0-1023)

The capability for completely arbitrary switching on the E1/T1 card means that integration of facilities provided by resource cards on the PEB buses or resource cards on the MVIP bus is possible. Switching between the SC-Bus and MVIP is also possible in some cases, but there are limitations imposed by the SC2000 device.

3.19 Default Jumper Settings for the E1/T1 Card

(Applicable to board identification: 10070 issue 5.3)

name	function	default
JP3	MVIP clock termination (C2)	not fitted
JP4	MVIP clock termination (C4N)	not fitted

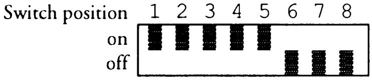
The following jumper settings apply to the 75-Ohm version of the E1 card only

name	function	default
J8(0)	Port 0 75 ohm Rx shield to 0V	not fitted
J8(1)	Port 0 75 ohm Tx shield to 0V	fitted as default
J8(2)	Port 1 75 ohm Rx shield to 0V	not fitted
J8(3)	Port 1 75 ohm Tx shield to 0V	fitted as default

Note that the 8-position jumper block J8 is situated on the Line Interface Module (LIM) such that jumpers may be changed without removing the LIM (See 4.19).

3.20 Default Switch Settings

S3 Card I/O base address



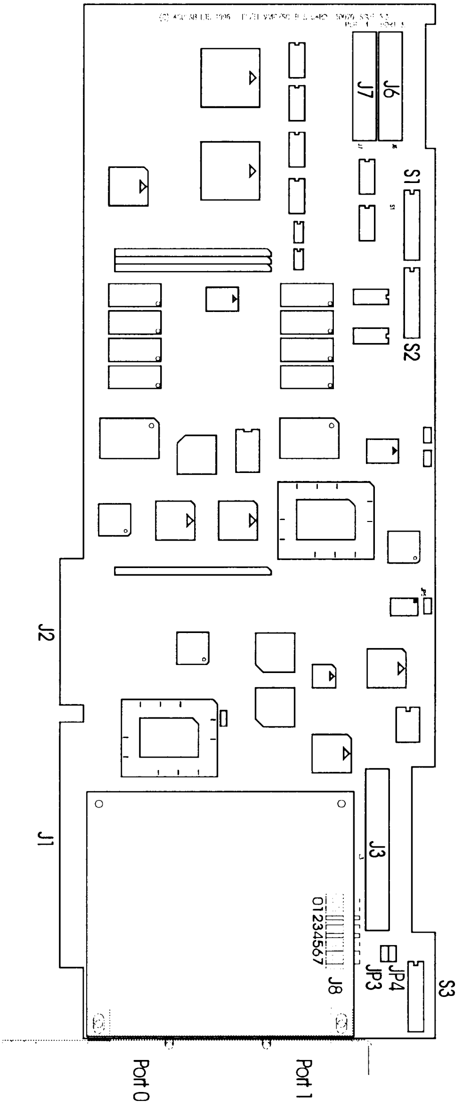
Switch ways (note reversed order)	8	7	6	5	4	3	2	1	–	–
Binary address	1	1	1	0	0	0	0	0	0	0
Hex address	3		8			0				

S1 name	Processor 1 Configuration switch function	default
S1-1	Port 0 RAM signalling code	On
S1-2	Port 0 RAM signalling code	On
S1-3	reserved	Off
S1-4	reserved	Off
S1-5	reserved	Off
S1-6	reserved	Off
S1-7	reserved	Off
S1-8	reserved	Off

S2 name	Processor 2 Configuration switch function	default
S2-1	Port 1 RAM signalling code	On
S2-2	Port 1 RAM signalling code	On
S2-3	reserved	Off
S2-4	reserved	Off
S2-5	reserved	Off
S2-6	reserved	Off
S2-7	reserved	Off
S2-8	reserved	Off

3.21 Jumper and Switch Positions

(applicable to board identification: 10070 issue 5.3)



Section 4 - Appendix 1 - General Approvals Information

This section provides information on the Approval of the E1/T1 card, and information that may affect the Approval status of the card in use. Failure to use the E1/T1 card in accordance with any of these instructions may invalidate the Approval for connection.

4.1 Model Number

These instructions for use refer only to the Aculab E1 Digital Access Card, models M1 and M2, the Aculab T1 Digital Access Card, models M1 and M2, and the E1/T1 Digital Access Card model M2.

4.2 Approval Details

The Approval Number and Approval Holder details are included in the appendices following **Country Specific Information**.

4.3 Usage and Type

The usage and type of connections supported by the E1/T1 cards are detailed in the appendices following **Country Specific Information**.

4.4 Environmental

The E1/T1 card is specified to operate within the following operating conditions:

Temperature 0 deg to 50 deg Celsius
Relative Humidity 10% to 95% non-condensing
Altitude 0 to 2,500 metres
Weight 0.3 Kg approx.

4.5 Network Timing

The E1/T1 card has been tested for compliance with the pulse and jitter requirements of CCITT G703, I431, ETS300-011 and in some cases additional national or international service requirements.

The E1/T1 card usually derives the timing for both of its network output ports from one of the network receive ports (the E1/T1 card model M1 only has port 0 present, the E1/T1 card model M2 has two ports present).

Alternatively, the E1/T1 card may be configured to derive the timing for both its network output ports from the MVIP bus or SC-Bus clock. The jitter performance required to maintain the card's approval status is only guaranteed if the external clock is derived from another Aculab E1/T1 card that is connected to the network. Other clock configurations may require further testing to ensure compliance.

4.6 Power Supply

The E1/T1 card takes its power from the host computer expansion bus and has the following power requirements:

1.5 Amps Max at +5V (DC) +/- 5%

It is the user's responsibility to ensure that the host computer will be able to safely supply the power required by the card in addition to any other auxiliary apparatus drawing power from it.

The card is specified to operate correctly with a tolerance (plus or minus) of 5% on the nominal dc power supply voltage.

4.7 Approved Functionality

Details of the approved functionality are included in the country specific appendices.

4.8 Approval Label

Users are reminded that when the card has been installed in a host computer it is still only the card that is approved so the Approval label must not be attached to the host.

4.9 Documentation Release

To ensure operation of the E1/T1 card consistent with the terms of Approval, it is essential to ensure that the card is accompanied by the correct release of the instructions for use, and is used in conjunction with appropriate device drivers.

If an application developer, by virtue of an application program, reduces the functionality of the E1/T1 card before delivery, then the instructions for use may be rewritten so that only the functionality implemented is described, provided that all of the sections regarding approval, installation and connection are retained.

4.10 Software Release

To ensure correct operation of the E1/T1, it is necessary that application programs be built using the correct release of software files for the particular revision of the E1/T1 card. To aid this process it is recommended that the application program read the major revision level from the device driver, and compares it with the major revision value for which their application was built and tested. The minor revision level is essentially a documentary indicator, but the major revision level value indicates a change that may impact the PC application.

The control software supplied to run on the card (downloaded to RAM) has been tested for compliance with the requirements of the Approval Authority referred to in the appendices following **Country Specific Information** for connection to the digital network. With a RAM-based card, the Approval label on the card is only valid and applicable if the card is used with the Aculab supplied signalling software appropriate for the Approval label.

Use of any other control software on a port connected to the PSTN is not covered by the Approval and reference must be made to the Approvals Authority before any connection to the network is made.

4.11 User Responsibilities

There may be configurations of the E1/T1 card along with other equipment that may require additional approval testing by an accredited test laboratory.

In particular, in producing the approval certificate for the card, the Approval Authority did not place any specific restriction on the use of the card apart from any restrictions listed in the appendices following **Country Specific Information**.

It is the responsibility of the user to ensure that all of the legal requirements for attachment are met, thus the user is advised to seek competent advice regarding any particular equipment configuration or use.

4.12 Speech Calls

If the E1/T1 card is used in an application that makes or answers calls with a service code that indicates a speech or telephony call, or any call that may use a partly analogue route, the Approval Authority may place requirements on the audio signals transmitted. Please refer to the appendices following **Country Specific Information** for more details.

Many of the speech and FAX resource cards that may be used with the E1/T1 card may comply with Approval Authority requirements, but it is the responsibility of the user to ensure that Approval requirements are complied with, by confirmation via the manufacturer of the card, or by any other suitable means such as independent testing.

Signal sources that do not in themselves guarantee compliance with Approval requirements must be conditioned by appropriate circuitry before transmission.

Section 5 - Appendix 2 - Country Specific Information

This appendix supplies the country-specific information to supplement the 'Instructions for Use' for the E1/T1 card. These appendices should always be read in conjunction with the other sections of 'Instructions for Use'.

The appendices are arranged in separate sections detailing regulatory requirements for the following countries:

Section 6 - USA & Canada
Section 7 - UK
Section 8 - European Union Countries
Section 9 - Japan (available in Japanese)
Section 10 - Australia

Section 6 - Appendix 3 - USA/Canada Approval Details

This section applies only to the 100 Ohm T1 version of the card.

6.1 FCC Connection Requirements

This equipment complies with Part 68 of the FCC Rules. The card has a label attached that contains, among other information, the FCC registration number for this equipment. If requested, provide this information to your telephone company.

Before connecting the card to the public network, you must inform the local Telephone Company of the following information:

Service Type	SOC	FIC	USOC
T1	6.0N	04DU9-1SN	NA
ISDN (PRI)	6.0N	04DU9-1SN	NA

A FCC compliant modular telephone jack is provided with this equipment. The equipment is designed to be connected to the telephone network or premises wiring using a compatible modular plug that is Part 68 compliant. See installation instructions for details.

If you telephone equipment containing the T1 Digital Access Card causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice isn't practical, you will be notified as soon as possible. You will be advised of your right to file a complaint with the FCC if you believe it is necessary.

Your telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of your equipment. If they do, you will be given advance notice so as to give you an opportunity to maintain uninterrupted service.

If you experience trouble with the T1 Digital Access Card please contact Aculab USA Inc. +1 (850) 7639281 for repair/warranty information. If your equipment is causing harm to the telephone network, the Telephone Company may request that you disconnect the equipment until the problem is resolved.

There are no user serviceable components on the card.

6.2 Industry Canada Warnings

The Industry Canada Label identifies certified equipment. This certification means that the equipment meets telecommunications network protective, operational and safety requirements as prescribed in the appropriate Terminal Equipment Technical Requirements document(s). The Department does not guarantee the equipment will operate to the users satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local Telecommunications Company. The equipment must also be installed using an acceptable method of connection. The customer should be aware that compliance with the above conditions might not prevent degradation of service in some situations.

A representative designated by the supplier should co-ordinate repairs to certified equipment. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

NOTICE: The Ringer Equivalence Number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Number of all the devices does not exceed 5.

Service Requirements

In the event of equipment malfunction, all repairs should be carried out by Aculab plc. It is the responsibility of users requiring service to report the need for service to our company.

In the USA and Canada, service can be obtained at:

Aculab USA, Inc.
132 Harrison Avenue,
Panama City,
Florida 32401
Phone/Fax: (850) 763 9281
E-mail: usa@aculab.com

6.2.1 Approval Number USA

Approval Type	FCC part 68 CN Component Registration
Approval Number	5TCGTB-24377-CN-N
Approval Holder	Aculab plc Lakeside, Bramley Road Mount Farm, Milton Keynes MK1 1PT, UK

FCC approves the apparatus for connection to public T1 services as specified in the approval certificate, this appendix, and the 'Instructions for Use' subject to the conditions set out in these documents.

Canada

Approval Type	Industry Canada CS-03 Issue 8
Approval Number	2789 8599 A

6.3 FCC EMC Requirements

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1) This device may not cause harmful interference, and

2) This device must accept any interference received, including interference that may cause undesired operation.

No changes or modification to the T1 card are allowed without explicit written permission from Aculab, as these could void the end user's authority to operate the device.

The card is intended for use only in commercial applications and should not be operated in a domestic environment. It must only be installed by a professional engineer and good quality shielded cables must be used between the network ports and the Channel Service Unit (CSU) to ensure continued compliance to EMC regulations.

6.4 Canadian EMC Requirements

This Class A digital apparatus meets all requirements of the Canadian interference-causing equipment regulations.

Cet appareil numerique de la Classe A respecte toutes les exigences du reglement sur le materiel brouilleur du Canada.

6.5 Usage and Type

The T1 card is principally designed for use connected to a 1544 Kbps T1 service configured for either robbed bit (CAS-BR) signalling or primary rate ISDN (PRI) with National ISDN 2 or 5ESS signalling. Other types of private circuit use are also appropriate, and other signalling systems are available or planned.

The file to be loaded into RAM for signalling software to connect to the network is:

NI2_USR.RAM (for NI-2 T1 PRI)

ATT_TUSR.RAM (for AT&T 5ESS T1 PRI)

M1T1RB.RAM (for robbed bit T1)

6.6 Functionality

- Call initiation
- Call clearing
- Call answering
- B-channel switching
- Host independent installation
- Application program generated by the user
- Independent Operation of the network ports (one or both ports attached to the public network)
- Operational code running from RAM

6.6.1 Speech Calls

If the T1 card is used in an application that makes or answers calls with a service code that indicates a speech or telephony call, or any call that may use a partly analogue route, there is a requirement that audio signals transmitted are encoded using CCITT μ-law PCM.

Many of the speech and FAX resource cards that may be used with the T1 card comply with this requirement. It is the responsibility of the user to ensure that this requirement is complied with, by confirmation via the manufacturer of the card, or by any other suitable means such as independent testing.

Signal sources that do not in themselves guarantee compliance with this requirement must be conditioned by appropriate circuitry before transmission.

6.7 Card Installation & Connection

6.7.1 Safety Warnings

Interconnection circuits should be such that the equipment continues to comply with the requirements of UL1950/CSA C22 for SELV circuits, after making connections between circuits using any of the internal ports.

Refer to a competent telecommunications engineer before installation and connection to the network is made.

L'avertissements concernant la sécurité

Quel que soit le matériel qui est raccordé aux port le système doit respecter les exigence de la norme CSA C22 au sujet des circuits SELV.

Il conviendra de rechercher l'avis d'un technicien de télécommunications avant l'installation de la carte et sa connexion au réseau.

6.7.2 Line Interface

Each network port on the card carries one service connection via a screened twisted pair cable of 100 ohm characteristic impedance. There is one transmit pair and one receive pair. A T1 service will normally carry 24 channels and a T1-PRI service will carry 23 channels. The card is designed to connect to an FCC or IC registered Channel Service Unit (CSU), which is not supplied by Aculab. The default line build out setting is suitable for cables up to 133 feet between the card and the CSU.

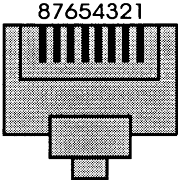
6.7.3 Network Cable Pinout

The 8-contact RJ48 (RJ45) Telephone Modular Plug on the cable between the card and the network must be wired as follows:

Pin	Signal	Function	Direction
4	LTT	Transmit (tip)	output
5	LTR	Transmit (ring)	output
1	LRT	Receive (tip)	input
2	LRR	Receive (ring)	input

RJ48 (RJ45) connector

(front View)



The cable and plug must be shielded types to ensure EMC compliance.

If a cable is to be produced to wire into a network trunk connection, the connector on the network end of the cable must be wired as appropriate for the network terminating unit or Channel Service Unit (CSU) provided.

A 'cross-over' cable is required to connect two T1 ports 'back-to-back', for example, when one port is to run an exchange end emulation and the other port a user end application. The cable should be wired as follows.

User End		Exchange End
4	to	1
5	to	2
1	to	4
2	to	5

Section 7 - Appendix 4 - Approval Details for UK

This section applies only to the 75 Ohm E1 version of the card.

7.1 Approval Number

Approval Type	BABT
Approval Number	NS/3941/15/N/603327
Approval Holder	Aculab plc Lakeside, Bramley Road Mount Farm, Milton Keynes MK1 1PT, England

The apparatus is approved by BABT for connection to telecommunications systems specified in this appendix and the 'Instructions for Use' subject to the conditions set out in these documents.

7.2 Usage and Type

The E1 card described here is designed

- for use connected to the Public Switched Telephone Network (PSTN) via a 2048 Kbps digital service using Channel Associated Signalling (CAS) of the type provided by:
  1. BT in the BT Callstream service and defined in SIN 204 and SIN 205
  2. Mercury Communications Plc and defined in MCL document SS5002
- For use connected to a 2048 Kbps Integrated Services Digital Network (primary rate ISDN) with DASS-2 signalling.
- For use connected to a private circuit using the CCITT G.703 interface at 2048 Kbps in this case the signalling is not specified, and for example includes DPNSS signalling.

7.3 Approved Functionality

The E1 card has obtained Approval for port types PD1 - (for Mercury CAS), PD2, 2DS, 3DS and 5C as defined by OFTEL document OTR001.

The E1 card has obtained Approval as a device having labelled ports.
The Approval is only applicable when the E1 card is used with Aculab supplied signalling software appropriate for the Approval.

For E1 cards with RAM, the filenames of the software to be loaded into RAM for signalling software to connect to the network are:

for BT CAS	M1BTCU.RAM
for Mercury CAS	M1PD1D.RAM
for DASS-2	DASS_USR.RAM
for DPNSS	M1DPNSS.RAM

7.3.1 CAS Approved Functionality

- Call initiation
- Call clearing
- Call answering
- Host independent installation
- Application program generated by the user
- Independent Operation of the network ports (one or both ports attached to the network)
- Operational code running from FLASH or loaded to RAM
- Major Equipment Failure (MEF) watchdog circuitry
- Data and speech operation

7.3.2 DASS-2 (on the PSN) Approved Functionality

- Data and speech operation using any appropriate SIC (Service Indicator Code)
- Call initiation using DASS-2 signalling
- Call clearing using DASS-2 signalling
- Call answering using DASS-2 signalling
- Selection of Supplementary Services
- Host independent installation
- Application program generated by the user
- Independent Operation of the network ports (one or both ports attached to the network)
- Operational code running from FLASH or loaded to RAM
- Major Equipment Failure (MEF) watchdog circuitry
- Host Watchdog security feature

Note: **The SIC determines the type of call being made, and the type of terminal equipment that may terminate the call.**

7.3.3 Speech Calls

If the E1 card is used in an application that makes or answers calls with a service code that indicates a speech or telephony call, or any call that may use a partly analogue route, there is a requirement that speech signals transmitted are encoded using CCITT A-law PCM, and do not exceed a 1 minute mean power level of -9dBm and that music signals are similarly encoded, and do not exceed a 1 minute mean power level of -12dBm.

Many of the speech and FAX resource cards that may be used with the E1 card comply with this requirement. It is the responsibility of the user to ensure that this requirement is complied with, by confirmation via the manufacturer of the card, or by any other suitable means such as independent testing.

Signal sources that do not in themselves guarantee compliance with this requirement must be conditioned by appropriate circuitry before transmission.

7.4 Card Installation & Connection

7.4.1 Safety Warnings

Under certain circumstances, because of installation into a host computer, or because of connection directly or indirectly with other apparatus, the E1 card could produce hazardous conditions on the network.

The connections via the edge-connector to the PC and the MVIP and SC-Bus/PEB ports (the 'labelled ports') do not themselves provide isolation sufficient to satisfy the requirements of EN60950:1992/A3:1996.

Thus the E1 card is approved only for installation to a host and with host attachments which are either type approved for such apparatus, or if supplied after March 1st 1989, are marked with or supplied with a statement that the host is supplied under General Approval Number NS/G/1234/J/100003. Any other usage will invalidate the Approval.

Note: **The forgoing condition is the same as that applying to any similar equipment with network attachment, such as internal/external Modems or FAX cards.**

The E1 card is not suitable for connection to cabling requiring Over Voltage Protection as defined in BS6701. (Most digital connections do not require overvoltage protection).

Refer to a competent telecommunication engineer before installation and connection to the network is made.

7.4.2 Installation and Safety

The table below summarises some of the safety requirements of EN60950:1992/A3:1996 with regard to proximity of parts of the E1 card to voltages present within the host PC.

Clearance mm	Creepage mm	Voltage present on other parts of the host or on expansion cards.
2.0	2.4 (3.8)	Up to 50V rms or dc
2.6	3.0 (4.8)	Up to 125V rms or dc
4.0	5.0 (8.0)	Up to 250V rms or dc
4.0	6.4 (10.0)	Up to 300V rms or dc
For a host or other expansion card fitted in the host, using or generating voltages greater than 300V (rms or dc), advice from a competent telecommunications safety engineer must be obtained before installation of the relevant equipment.		Above 300Vrms or Vdc

Clearance distances refer to the shortest distance between parts, measured through air. Creepage distances refer to total distances measured across surfaces when installed in a normal office environment. The creepage distances in parentheses apply where the local environment within the PC is subject to conductive pollution, or dry non-conductive pollution that could become conductive due to condensation.

Except at the edge connector which plugs into the PC's expansion slot, and at the SC Bus/PEB and MVIP buses, these creepage and clearance distances must be maintained between conductors on the E1 card and any parts of the host or other expansion cards carrying the voltages indicated.

If in doubt, seek advice from a competent telecommunication safety engineer.

Failure to install the E1 PC card in accordance with these instructions will invalidate the Approval.

7.4.3 Line Interface

Each network port on the card carries one 30-channel service connection via a pair of 75 ohm characteristic impedance coaxial cables. There is one transmit cable and one receive cable.

The coaxial connectors used on the card are SMB types. Every card containing one or two 75 Ohm network ports is supplied with SMB to BNC adapters that may only be fitted after the card is installed in the host PC. The adapters are a push fit so some form of strain relief is recommended.

7.4.4 Network Connection

The connection of the network input and output ports on the E1 card to the network termination port (NTP) must be via coaxial cables with a nominal impedance of 75 ohms terminated with a 75 ohm BNC plug. There may be maximum cable lengths imposed by the PTO.

The model M2 of the E1 card has two E1 ports, the lower two coax connectors on the endpanel of the card are port 0, and the upper two connectors are port 1. Model M1 has only a single port, port 0.

The cable connected to the input port on the E1 card (the lower BNC connector of each pair on the endpanel) must be connected to the output of the NTP and the cable connected to the output port (the upper BNC connector of each pair on the endpanel) must be connected to the input of the NTP.

The identification of the input and output of the network termination port is the responsibility of installation personnel.

7.4.5 Earthing/Grounding of Input and Output Ports

A jumper is provided on the E1 card to enable the functional earth/ground to be either connected to or isolated from the conductors at the output ports that are to be connected to the outer conductors of the coaxial cables connected to the NTP. These jumpers (J8[1] for port 0 and J8[3] for port 1) are normally configured as **connections** during manufacture, and must only be reconfigured after installation by agreement with the PTO.

A jumper is provided on the E1 card to enable the functional earth/ground to be either connected to or isolated from the conductor at the input ports that are to be connected to the outer conductors of the coaxial cables connected to the NTP. These jumpers (J8[0] for port 1 and J8[2] for port 2) are normally configured as **open circuit** during manufacture, but may be reconfigured after installation at the discretion of the PTO.

Initial installation of the E1 card should be with J8 as supplied, as described above. Normally, there will be no reason at all to alter the settings of these jumpers.

7.4.6 Network Connection via Other Apparatus

If other apparatus, including cable or wiring, is to be connected between the E1 card and the point of connection to the network, then all of that apparatus must comply with the following:

a) The overall transmission characteristic of all the other apparatus, upon electrical conditions presented to one another by the apparatus and the network connection, shall be such as to introduce degradation no greater than the requirement for direct connection. The attenuation shall be assumed to follow the √f law, and the loss at a frequency of 1024KHz shall not exceed 6dB.

b) All that other apparatus shall comprise only apparatus approved for the purpose of connection between the apparatus and the network. Cable, wire and wiring accessories shall comply with Approval No: NS/G/1235/M/100009 Section 22, Telecommunications Act 1984 Approval of cable, wire and wiring accessories for connection between certain digital telecommunication apparatus, published by OFTEL.

c) The installation should comply with the Wiring Code Part 2, published by OFTEL.

7.5 The MEF Watchdog

Once running, the DASS-2 port processors enable an internal 'watchdog' timer that they must persistently and regularly update. Any error condition that causes processing to falter will cause the watchdog to generate a processor reset. This is the 'Major Equipment Failure' (MEF) condition, and will result in a 'no signal' being presented at the particular G703 output port, which is the required behaviour under these conditions.

Section 8 - Appendix 5 - Approval Details For European Union Countries

This section applies only to the 120 Ohm E1 version of the card.

8.1 CE Approval

Approval Type	CE 168X
Approval Holder	Aculab plc Lakeside, Bramley Road Mount Farm, Milton Keynes MK1 1PT, England UK

The apparatus is approved by NET5/CTR4/ETS300 for connection to primary rate ISDN as specified in this appendix, and the 'Instructions for Use' subject to the conditions set out in these documents.

Service Requirements

In the event of equipment malfunction, all repairs should be carried out by Aculab plc. It is the responsibility of users requiring service to report the need for service to our company.

Service can be obtained at:

Aculab plc
Lakeside, Bramley Road
Mount Farm, Milton Keynes
MK1 1PT, England
UK

Phone : +44 1908 273800
Fax : +44 1908 273801
E-mail : support@aculab.com

EN55022 declaration

This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

No changes or modification to the E1/T1 card are allowed without explicit written permission from Aculab, as these could void the end user's authority to operate the device.

8.2 Usage and Type

The E1 card is principally designed for use connected to a 2048 kb/s integrated services digital network (primary rate ISDN) with ETS300-102 signalling, but other types of private circuit use are also appropriate, and other signalling systems are available or planned.

The Approval is only applicable when the E1 card is used with Aculab supplied signalling software appropriate for the Approval.

For E1 cards with RAM, the filename for the software to be loaded into RAM for signalling software to connect to the network is:

ETS_USR.RAM

8.3 Approved Functionality

- Call initiation using ETS300-102 signalling
- Call clearing using ETS300-102 signalling
- Call answering using ETS300-102 signalling
- Host independent installation
- Application program generated by the user
- Independent Operation of the network ports (one or both ports attached to the network)
- Operational code running from RAM

8.3.1 Speech Calls

If the E1 card is used in an application that makes or answers calls with a service code that indicates a speech or telephony call, or any call that may use a partly analogue route, there is a requirement that audio signals transmitted are encoded using CCITT A-law PCM, and do not exceed a 1 minute mean power level of -9dBm.

Many of the speech and FAX resource cards that may be used with the E1 card comply with this requirement, but it is the responsibility of the user to ensure that this requirement is complied with, by confirmation via the manufacturer of the card, or by any other suitable means such as independent testing.

Signal sources that do not in themselves guarantee compliance with this requirement must be conditioned by appropriate circuitry before transmission.

8.4 Card Installation & Connection

8.4.1 Safety Warnings

Interconnection circuits should be such that the equipment continues to comply with the requirements of 2.3 of EN 60950 for SELV circuits, after making connections between circuits using any of the internal ports.

The host PC into which the E1/T1 Card is fitted is classed as an indirect attachment. This is because the ISA bus connector provides an interconnection circuit between the host PC and the E1/T1 Card. Similarly, equipment connected to the E1/T1 Card MVIP or SC/PEB Bus ports are also classed as indirect attachments.

The E1/T1 Card is approved for use only with indirect attachments that are either type approved themselves or, if supplied after 1st March 1989, meet the General Approval NS/G/1234/J/100003. Any other usage will invalidate the approval.

Please note that the above requirement is the same as that which applies to any similar equipment with network attachment, such as internal/external Modem or FAX cards.

8.4.2 Line Interface

Each network port on the card carries one 30-channel service connection via a screened twisted pair cable of 120 ohm characteristic impedance. There is one transmit pair and one receive pair.

8.4.3 Network Cable Pinout

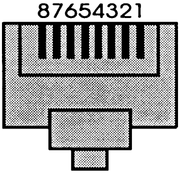
The 8-contact RJ45 Telephone Modular Plug on the cable between the card and the network must be wired as follows:

Pin	Signal	Function	Direction
4	LTT	Transmit (tip)	output
5	LTR	Transmit (ring)	output
1	LRT	Receive (tip)	input
2	LRR	Receive (ring)	input

The cable and plug must be shielded types to ensure EMC compliance.

RJ45 Connector

(front View)



If a cable is to be produced to wire into a network trunk connection, the connector on the network end of the cable must be wired as appropriate for the network terminating unit provided.

A 'cross-over' cable is required to connect two E1 cards 'back-to-back', for example, when one card is to run an exchange end emulation and the other card a user end application. The cable should be wired as follows.

User End		Exchange End
4	to	1
5	to	2
1	to	4
2	to	5

8.4.4 Installation and Safety

The card must be installed such that, with the exception of the ISA bus, MVIP and SC/PEB connections, clearance and creepage distances shown in the table below are maintained between the E1/T1 card and any parts of the host PC or other expansion cards which use or generate a voltage, shown in the following table below.

Clearance mm	Creepage mm	Voltage present on other parts of the host or on expansion cards.
2.0	2.4 (3.8)	Up to 50V rms or dc
2.6	3.0 (4.8)	Up to 125V rms or dc
4.0	5.0 (8.0)	Up to 250V rms or dc
4.0	6.4 (10.0)	Up to 300V rms or dc
For a host or other expansion card fitted in the host, using or generating voltages *greater* than 300V (rms or dc), advice from a competent telecommunications safety engineer must be obtained before installation of the relevant equipment.		Above 300V rms or dc

Clearance distances refer to the shortest distance between parts, measured through air. Creepage distances refer to total distances measured across surfaces when installed in a normal office environment. The creepage distances in parenthesis apply where the local environment within the PC is subject to conductive pollution or dry non-conductive pollution that could become conductive due to condensation.

If in doubt seek advice from a competent telecommunications safety engineer.

In order to maintain the host independent approval of the E1/T1 Card, it is essential that, when other (non E1/T1) expansion cards are introduced which use or generate a hazardous voltage, the minimum creepage and clearances specified above are also maintained. A hazardous voltage is one that exceeds 42.4V ac peak or 60V dc. If you have any doubt, seek advice from a competent engineer before installing other adapters into the host equipment.

Failure to install the E1/T1 card in accordance with these instructions will invalidate the Approval.

Section 9 - Appendix 6 - Approval Details for Japan

9.1 Approval Number

Approval Number	T98-6315-0 (JATE)
Approval Holder	Aculab plc Lakeside, Bramley Road Mount Farm, Milton Keynes MK1 1PT, UK

Aculab is in the process of seeking approval by JATE for connection to public primary rate ISDN as specified in this appendix, and the 'Instructions for Use' subject to the conditions set out in these documents.

9.2 Usage and Type

The T1 card is principally designed for use connected to a 1544 Kbps integrated services digital network (primary rate ISDN) with INS signalling, but other types of private circuit use are also appropriate, and other signalling systems are available or planned.

The Approval will only be applicable when the T1 card is used with Aculab supplied signalling software appropriate for the Approval.

The file to be loaded into RAM for signalling software to connect to the network is:

INS_USR.RAM

9.3 Functionality

- Call initiation
- Call clearing
- Call answering
- B-channel switching
- Host independent installation
- Application program generated by the user
- Independent Operation of the network ports (one or both ports attached to the public network)
- Operational code running from RAM

9.4 Speech Calls

If the T1 card is used in an application that makes or answers calls with a service code that indicates a speech or telephony call, or any call that may use a partly analogue route, there is a requirement that audio signals transmitted are encoded using CCITT μ-law PCM, and do not exceed a 1 minute mean power level of -9dBm.

Many of the speech and FAX resource cards that may be used with the T1 card comply with this requirement, but it is the responsibility of the user to ensure that this requirement is complied with, by confirmation via the manufacturer of the card, or by any other suitable means such as independent testing.

Signal sources that do not in themselves guarantee compliance with this requirement must be conditioned by appropriate circuitry before transmission.

9.5 Card Installation & Connection

9.6 Safety Warnings

Interconnection circuits should be such that the equipment continues to comply with the requirements of 2.3 of EN 60950 for SELV circuits, after making connections between circuits using any of the internal ports.

Refer to a competent telecommunications engineer before installation and connection to the network is made.

9.7 Line Interface

Each network port on the card carries one 23-channel service connection via a screened twisted pair cable of 100 ohm characteristic impedance. There is one transmit pair and one receive pair.

The card is designed to connect to a Data Service Unit (DSU) (NT1) as supplied by NTT.

9.8 Network Cable Pinout

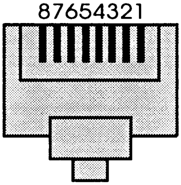
The 8-contact RJ45 Telephone Modular Plug on the cable between the card and the network must be wired as follows:

PIN	SIGNAL	FUNCTION	Direction
4	LTT	Transmit (tip)	output
5	LTR	Transmit (ring)	output
1	LRT	Receive (tip)	input
2	LRR	Receive (ring)	input

The cable and plug must be shielded types to ensure EMC compliance.

RJ45 Connector

(front View)



If a cable is to be produced to wire into a network trunk connection, the connector on the network end of the cable must be wired as appropriate for the network terminating unit (DSU) provided.

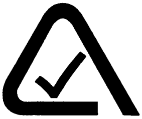
A 'cross-over' cable is required to connect two T1 ports 'back-to-back', for example, when one port is to run an exchange end emulation and the other port a user end application. The cable should be wired as follows:

User End		Exchange End
4	to	1
5	to	2
1	to	4
2	to	5

Section 10 - Appendix 7 – Approval details for Australia

10.1 Approval Type

C-Tick Mark (EMC)



A-Tick Mark (Telecom)

Supplier Identification	N1324
Approval Holder (parent company)	Aculab plc Lakeside, Bramley Road Milton Keynes, MK1 1PT England UK

Approval by the ACA for connection to primary rate ISDN, held by the local subsidiary of Aculab, is as specified in this document, subject to the conditions set out in this appendix.

10.2 Usage and Type

The E1 card is principally designed for use connected to a 2048 Kbps integrated services digital network (primary rate ISDN) with TS014 signalling.

Other types of private circuit use are also appropriate, and other signalling systems are available or planned.

The ACA Approval is only applicable when the El card is used with Aculab supplied signalling software appropriate for the Approval.

The filename for the software to be loaded into RAM for signalling software to connect to the network is:

AUST_USR.RAM (TS014 protocol)
TS038USR.RAM (TS038 protocol)

10.3 Approved Functionality

Call initiation using TS014/TS016 signalling Call clearing using TS014/TS016 signalling Call answering using TS014/TS016 signalling Host independent installation Application program generated by the user Independent Operation of the network ports (one or both ports attached to the network) Operational code running from EPROM or loaded to RAM

10.4 Speech Calls

If the E1 card is used in an application that makes or answers calls with a service code that indicates a speech or telephony call, or any call that may use a partly analogue route, there is a requirement that audio signals transmitted are encoded using CCITT A-law PCM, and do not exceed a 1 minute mean power level of -9dBm.

Many of the speech and FAX resource cards that may be used with the E1 card comply with this requirement. It is the responsibility of the user to ensure that this requirement is complied with, by confirmation via the manufacturer of the card, or by any other suitable means such as independent testing.

Signal sources that do not in themselves guarantee compliance with this requirement must be conditioned by appropriate circuitry before transmission.

10.5 Card Installation & Connection

10.6 Safety Warnings.

1. The Primary Rate E1 ISDN Interface is a TNV interface as detailed in section 6 of AS3260. In order to meet the safety requirements of AS 3260 and TS001, a Line Isolating Unit (LIU) has been supplied for connection between the E1 Interface card and network.

   Where equipment is intended to be electrically connected to other equipment, interconnection circuits shall be selected to provide continued conformance with the requirements of section 2.3 for SELV circuits, and with the requirements of clause 6 for TNV circuits, after making connections between equipment's.

   Make sure that the integrity of the SELV system is maintained when connection is made through any other interface port within the system. If in any doubt seek competent advice.

   All host equipment incorporating the E1 ISDN Interface *must* be earthed.

2. The LIU is a Pascom 2115J. This LIU provides a supplementary barrier to protect against over voltage between Network (TNV) and SELV. The LIU is provided to allow compliance with section 6.4 of AS3260 for protection of the equipment user from voltages on the Telecommunication Network.

3. The LIU comes attached with a small breakout cable, this must be connected into the E1 card Port. An ACA or CCL listed approved Primary Rate cable (having been assessed to TS008) must be used to connect from the LIU to the network. If a Dual Port E1 card has been ordered then two LIU's will be supplied.

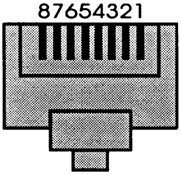
Note: **Connection via the LIU to the Network is a Mandatory Requirement. Approval for connection against TS014 has been gained with the E1 Card PLUS the LIU. Failure to do so will invalidate any Australian approval obtained and any warranty released by Aculab. Liability for such actions will be the responsibility of the user.**

10.7 Network Cable Pinout

The 8-contact RJ45 Telephone Modular Plug on the cable between the LIU and the network must be wired as follows:

RJ45 Connector

(front View)



Pin	Signal	Function	Direction
4	LTT	Transmit +ve (tip)	output
5	LTR	Transmit –ve (ring)	output
1	LRT	Receive +ve (tip)	input
2	LRR	Receive –ve (ring)	input

If a cable is to be produced to wire into a network trunk connection, the connector on the network end of the cable must be wired as appropriate for the network-terminating unit provided.

If a 'cross-over' cable is to be produced to connect two El cards 'back-to-back', for example, when one card is to run an exchange end emulation and the other card a user end application, the cable may be wired as follows.

User End		Exchange End
4	to	1
5	to	2
1	to	4
2	to	5

With such a connection, the connections between the cards must be arranged as follows:

El card--LIU cable -- LIU -- Cross-Over cable -- LIU - LIU cable -- E1 card

Under no circumstances should cards be directly connected, or connected via only a single LIU.

Section 11 - Technical Specifications

Connectors

8 way RJ45/RJ48 balanced (120R/100R)
SMB/BNC for E1 unbalanced (75R)

Line interface

E1 2Mbit to G703/G704/I431
Doubleframe, CRC4 multiframe and CAS multiframe supported
HDB3 line encoding
T1 1.544Mb to G703/G704/ANSI T1.403
D4 and ESF support
AMI or B8ZS line encoding

TDM interfaces

Enhanced compliant MVIP interface supporting 256 channels
SCBus interface supporting 512 channels at 4Mbits
Optional PEB mode supporting 2 x 32 channels at 2Mbits

Switching

60/48/46 channel switching between network and TDM ports (E1/T1)
256 channel switching on MVIP
512 channel switching on SCBus
120 channel switching to optional DSP resource card

Device drivers

MS DOS, OS/2, Windows NT (on X86), Solaris (on X86), DEC Alpha UNIX, SCO & INT UNIX, Univel UNIX and Concensys

Signalling

Common Channel Signalling Q921/Q931 (E1/T1 ISDN) and many national variants
Channel Associative Signalling - common channel (E1)
Channel Associative Signalling - Robbed Bit (T1)

Optional DSP module

MF and DTMF detection and generation
Up to 27-channel conferencing (any combination)
PC Bus Interface
I/O registers at mod 4 address (0x100-0x3FC)
Memory window 16k at mod 16k address
Memory sharing with some Dialogic and VCS cards
Software configurable interrupts 3, 5, 7, 10, 11, 12, 14, and 15
Interrupt sharing between Aculab cards

Clocking

Can slave from either network port
Can slave from MVIP or SCBus
Can master on all ports

Local clock reference within 32ppm of nominal

Embedded processors

Independent signalling processors for each port
2 x 80C188 at 20MHz with 512k RAM each EMC certification
Complies with EN55022 Class B (emissions) and EN50082-1 (immunity) FCC part 15 Class A, AS3548 Class B (emissions)
Complies with IEC950, UL1950, EN60950, AS3260, TS001 (safety)

Power supply

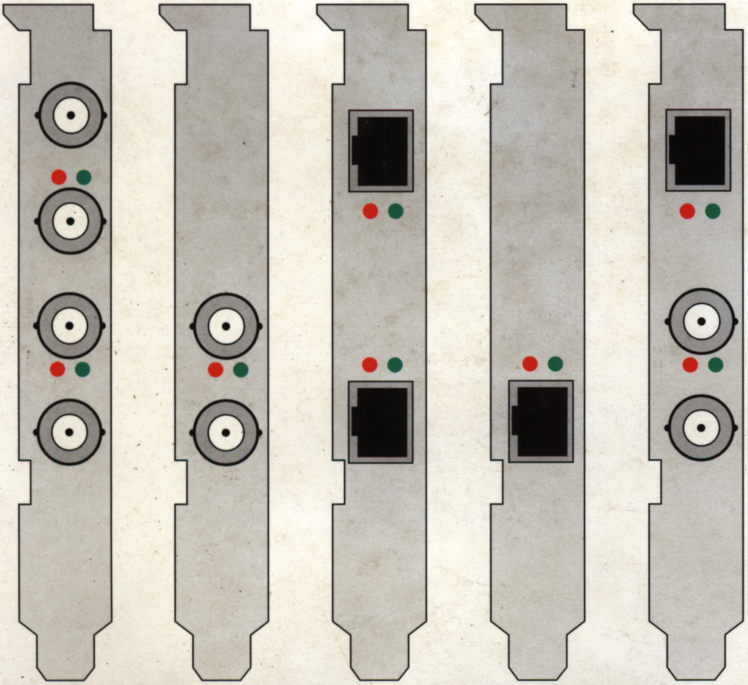
+5V DC @ 1.3A max ± 5%

Temperature

0° - 50°C operating temperature
5% - 90% humidity (non-condensing)

Physical

Full length 16 bit PC ISA card



	75Ω - E1		120Ω - E1 100Ω - T1		100Ω/120Ω+75Ω
CHANNELS	60	30	60/48	30/24	54
CONNECTOR	BNC	BNC	RJ45	RJ45	BNC + RJ45
MVIP	1	1	1	1	1
PEB or	2	2	2	2	2
SCBUS	1	1	1	1	1

World Wide Web
http://www.aculab.com

aculab

e-mail
support@aculab.com

Aculab plc (UK), Lakeside, Milton Keynes, MK1 1PT, England, UK. Tel: +44 1908 273800. Fax: +44 1908 273801
Aculab USA Inc (FL), 132 Harrison Avenue, Panama City, FL 32401, USA. Telephone and Fax: +1 850 763 9281
Aculab USA Inc (CA), 204 E 2nd Ave., Ste. 423, San Mateo, CA 94401, USA. Tel: +1 650 548 1839 Fax: +1 650 347 4684
Aculab GMBH i.G. (Germany) Garmischerstrasse 8, D-80339 Munich, Germany. Tel: +49 89 508071-0 Fax: +49 89 508071-77